

On Leucochloridium paradoxum and the Development of the Larvæ contained in it into Distoma. By DR. ERNST ZELLER.

In this memoir the author gives some new details upon *Leucochloridium*, and especially describes the experiments which have led him to the discovery of the species of *Distomum* into which the *Cercaria* contained in this singular nurse are transformed. We shall dwell here more particularly upon what relates to the migration of this Trematode into its definitive host.

By keeping some *Succineæ* in confinement Dr. Zeller was enabled to observe the growth of the *Leucochloridium* through their integuments. It takes about four weeks for a sac to be developed so as to become visible in the anterior part of the mollusk, and three weeks more for it to acquire its full development.

When one of the sacs has acquired its full dimensions and moved for a certain time in the tentacle of a *Succinea*, the integuments of the mollusk become so thin in this region as to be ruptured by the action of a slight pressure from without. When such a rupture is produced, the *Leucochloridium* projects from the tentacle and continues for a considerable time to move actively, although still adhering at the base by its filiform pedicle. It may be artificially detached from the mollusk without the latter seeming to suffer from the operation. The *Succinea* then remains contracted for some hours; then it begins again to creep and to take food. If it is kept in favourable conditions, another sac may be developed to replace that which has been removed.

M. von Siebold put forward the supposition that the larva (*Cercaria caefoliata*, Moulinié) contained in *Leucochloridium* produced the *Distomum holostomum* which inhabits the rectum of several marsh birds, such as *Rallus aquaticus*, *Gallinula chloropus* and *G. porzana*. Dr. Zeller, on his part, observed *Succineæ* infested by *Leucochloridium* in localities where it seemed to him the waders just mentioned could not be met with, but which were, on the contrary, inhabited by various birds of the family Sylviadæ. He was thus led to suppose that these last might be the true hosts into which the *Leucochloridium* migrated. This supposition seemed to him to become almost a certainty when he found *Distomum macrostomum*, Rud., in a redbreast, as the organization of that species is in almost complete concordance with that of the larva contained in *Leucochloridium*. This *Distomum*, the organization of which the author very carefully describes, has hitherto been observed only in the redbreast and some other species of the same group, such as the nightingale, one or two warblers, and two wagtails. All these birds are insectivorous, and none of them feed upon mollusks. Dr. Zeller supposed that they tore off the *Leucochloridium* from the tentacles of the *Succinea*, as its resemblance to the larva of an insect is striking. To verify this hypothesis he offered to a tame redbreast a *Succinea* containing *Leucochloridia* which had pushed into the tentacles. The bird immediately came down upon one of these

saes, tore it out of the tentacle, and swallowed it. Several other similar experiments gave the same result. The most interesting was one in which, a mealworm having been placed side by side with a *Succinea*, the author saw a blackcap seize first the *Leucochloridium* and afterwards the mealworm. In all these experiments it was observable that the bird, after having seized the *Leucochloridium* and torn it out with a single strike of the bill, swallowed it, sometimes immediately, sometimes only after striking it several times against the floor of its cage or the perch, thus behaving exactly as the insectivorous birds do with their ordinary food.

From the success of these first experiments Dr. Zeller had great hopes of being able to confirm his hypothesis by the autopsy of the birds. So his disappointment was great when he did not find a single *Distomum macrostomum* in three redbreasts and a blackcap which he dissected some weeks after he had seen them swallow the *Leucochloridia*. He then questioned whether the larvæ of *Distomum* contained in the *Leucochloridia* had been quite *mature*, or whether, perhaps, the artificial nourishment of the birds might not have exercised an injurious influence upon the parasites. In order to avoid these causes of failure he made fresh experiments, employing this time some *Succineæ* which had been kept for a long time in captivity, and containing *Distomum*-larvæ, the development of which could not but be sufficiently advanced; and at the same time, instead of cage-birds, he made use of young birds in a free state, but still in the nest. These birds were shut up with their nests in small cages, and left in a place where they could be fed by their parents.

Three series of experiments, made under these conditions, upon whitethroats (*Curruea garrula*), blackcaps, and wagtails were crowned with full success. The *Distoma* were fixed in the rectum in great numbers and very lively; their reproductive organs presented a state of development more or less advanced, according to the length of time they had remained in the intestinal canal of their host. In some of them the oviducts were to be seen filled with ova, some of which even were already of an intense yellow colour. The development of the larva of *Distomum macrostomum* into the adult animal is very rapid; and the production of the ova seems to commence within six days after the migration.

Dr. Zeller completes his memoir with some observations on the species allied to *D. macrostomum*, and upon the hosts which furnish nourishment for these different species of *Distomum*. He considers that Diesing was wrong in combining with *D. macrostomum* the *D. erraticum* and *D. ringens* of Rudolphi. On the other hand, he convinced himself that *D. mesostomum*, Rud., which occurs in the song-thrush, the grosbeak, the bullfinch, and the greenfinch, is quite distinct from *D. macrostomum*. But *D. holostomum*, Rud., from the water-rails and the common water-hen, which M. von Siebold supposed to be the adult form of the larva of *Leucochlori-*

dium, presents all the same characters as *D. macrostomum*, from which it differs only in size. Its length is from $\frac{1}{4}$ to $2\frac{1}{2}$ lines, while that of *D. macrostomum* is only $\frac{1}{2}$ to $\frac{2}{3}$ line. These two forms would therefore seem to constitute only a single species, which attains larger dimensions in the Waders than in the Passerine birds.

The author concludes with some remarks upon the singular mimetism presented by the *Leucochloridium*, the resemblance of which to the larva of an insect cannot fail to strike all who examine that singular parasite. In his opinion, this resemblance, destined to deceive insectivorous birds, has a teleological significance; for it does not serve for the protection or preservation of the creature, but rather leads to its destruction. It is true that this destruction is associated with the development of the larvæ contained in it; "but," says the author, "no one can suppose that our *Leucochloridium* thus sacrifices its own existence to secure that of its progeny." Agreed! but no naturalist has ever asserted that mimetism was due to an effect of the will of the creature that imitates. It shows a very erroneous conception of the theory of mimetism, and consequently of that of selection, to suppose that it ascribes the modifications of the species to voluntary actions of the individuals; and we are sorry to see Dr. Zeller make use of the interesting facts that he has discovered in support of such reasoning. In the great struggle for existence the species is all, the individual almost nothing; and what can be more favourable to the preservation of the species than this deceptive imitation which leads to the sacrifice of an individual without organs, such as *Leucochloridium*, in order to secure to the larvæ of the *Distomum* their transportation into the intestine of an insectivorous bird, where they can acquire their definitive development and become fitted to reproduce their kind.—*Zeitschr. für wiss. Zool.* vol. xxiv. (1874), p. 564; *Bibl. Univ., Bull. Sci.* 1874, p. 366.

The Diatomeæ of the Carboniferous Period.

By Count F. CASTRACANE.

The author believing that, although hitherto undetected, Diatomeæ must have existed at the time of the formation of coal, hit upon the ingenious expedient of examining with the microscope the ashes of coal, instead of the thin sections previously studied. In this way he has succeeded in ascertaining the presence in coal, received from Liverpool, of a great number of species of Diatoms. Most of them belong to freshwater genera or species; but the presence of marine species mixed with these seems to prove that the ground in which this coal was formed was in more or less frequent communication with the sea.—*Actes de l'Acad. Pontif. des Nuovi Lincei*, February 1874; *Bibl. Univ., Bull. Sci.* 1874, p. 376.